

CLOTHES DRYER

Field of the Invention

5 The present invention relates to a clothes dryer for use in a clothes drying device for drying clothes by blowing dry warm air into a rotary drum accommodating laundry therein to thereby make moisture in the clothes evaporated by the air or for use in a washing and drying machine having a clothes drying function added to a washing machine.

10

Background of the Invention

To dry clothes in a clothes dryer or a washing and drying machine, clothes accommodated in a rotary drum is agitated by rotating the rotary drum, during which heated
15 air is blown into the rotary drum, thereby exposing the clothes to the air. As a result, moisture in the clothes is evaporated by the heated air, and the resulting damp air containing the moisture from the clothes is exhausted from the rotary drum to be dehumidified and reheated. The
20 dehumidified hot air is then re-circulated into the rotary drum to further dry the clothes. By repeating this dry cycle, the clothes are dried.

As the dry cycle proceeds, lint such as threads would be separated from the clothes, and it would stick to an air
25 flow duct or a blower, resulting in deterioration of air blowing and drying capacity. To solve the problems, a lint

trap filter is disposed at a preset position in the air flow duct to capture the lint from the air, thus preventing the lint from sticking to the blower or the air flow duct. However, if the amount of the lint captured by the lint trap filter increases, the filter will be clogged, causing a reduction in air blow capacity. For the reason, the lint trap filter is configured such that it is readily detachable from the air flow duct thereby allowing a user to clean the filter by removing the lint from the filter. That is, for the lint trap filter, high maintenance convenience is required as well as a high performance in capturing the lint.

To facilitate the capture of the lint, there has been proposed a lint trap filter having a dual system of two filters (see, for example, Japanese Patent Laid-open Application No. 2001-300192). The lint trap filter is installed at an upper rear surface portion of a washing and drying machine, and it has a plane-shaped filter and a bag-shaped filter disposed in parallel to each other. The two filters are configured to have different mesh densities so that they can capture different sizes of lint. Further, by using the bag-shaped filter, a larger lint capturing area can be obtained.

For such a conventional lint trap filter, however, the filter unit is constructed to be detached from the rear portion of the washing and drying machine for maintenance by dragging it upward, which is inconvenient. Further, to

clean the two filters individually, the assembly of the two filters needs to be disassembled, which makes the maintenance work for the lint trap filter troublesome.

Moreover, though the bag-shaped filter is capable of providing a large lint capturing area, it is difficult to remove the lint therefrom when the lint is accumulated therein.

Summary of the Invention

Embodiments of the present invention seek to provide a clothes dryer having a lint trap filter disposed in a dry air circulation channel and capable of providing an improved lint capturing performance and a high maintenance convenience, thus preventing a deterioration of drying capacity.

In accordance with a first aspect of the present invention, there is provided a clothes dryer comprising: a housing having a filter accommodation room in a upper portion of the housing;

a drying chamber for accommodating clothes therein; a drying air circulation channel for blowing hot air heated by a heating unit into the drying chamber, for exhausting damp air containing moisture evaporated from the clothes from the drying chamber, for running the damp air through a dehumidification unit, for re-heating the dehumidified air with the heating unit and for re-circulating the heated air back into the drying chamber; and a lint trap filter, installed in an air flow path of the air

circulation channel, for filtering lint from air flowing therethrough,

wherein the lint trap filter is configured to be installed at a preset position in the filter accommodation room by being pushed inward from a front surface portion of the housing and to be unloaded from the filter accommodation room by being pulled outward from the front surface portion of the housing,

wherein an intake opening for introducing air from the drying chamber is provided at a front bottom portion of the filter accommodation room, and a discharge opening for exhausting the introduced air is provided at a rear bottom portion of the filter accommodation room,

wherein the lint trap filter is formed of a filter formation surface which has an air introduction opening opened toward the intake opening and is expanded in a bag shape toward the discharge opening,

wherein the filter formation surface is formed of an assembly of a first filter formation portion and a second filter formation portion, each being formed by attaching a filter sheet to openings provided at a peripheral wall of a half-shell shaped receptacle, and the first filter formation portion and the second filter formation portion are detachably connected to each other at a position between peripheries of the openings of the respective filter formation portions, and

wherein the first filter formation portion is arranged

to face the discharge opening to form a mainstream air flow path and the second filter formation portion is arranged to be positioned above the first filter formation portion to form a sub-stream air flow path in communication with the discharge opening through an upper part and a rear part of the filter formation surface.

In the above configuration, the filter formation surface expanded toward the downstream of the air flow in the air flow path can be given a large lint capturing area by attaching filters to openings provided at the peripheral wall thereof. Thus, it is possible to capture lint efficiently from the air flowing in the air flow path, so that a deterioration of drying capacity and/or an occurrence of operation failure due to the accumulation of lint in a blower and/or in the air circulation channel can be prevented in advance.

Preferably, in example embodiments, the filter formation surface has a shell structure formed of an assembly of a first and a second filter formation portion, each being formed by attaching a filter to an opening provided at a peripheral wall of a half-shell shaped receptacle, and the first and the second filter formation portion are detachably connected to each other at peripheries of the openings, while providing an air introduction opening at upstream of the air flow in the air flow path. The bag-shaped filter formation surface is formed by assembling the two filter formation portions by means of a fitness mechanism or a slide mechanism. Further,

by separating the two filter formation portions, the task of removing lint accumulated in the bag can be performed easily.

Previously, the first filter formation portion and the second filter formation portion are detachably connected to each other via a hinge mechanism at downstream of the air flow. As a result, the bag-shaped filter formation can be opened easily, allowing the lint accumulated therein to be removed simply. Therefore, maintenance convenience can be improved.

Previously, the first filter formation portion is located in a mainstream passage of the air flow path, while the second filter formation portion is located in a sub-stream passage of the air flow path. Thus, in case the air permeability of the first filter formation portion is reduced due to the lint accumulated therein, the mainstream of the air is allowed to flow toward the second filter formation portion. Therefore, the time required for the air blow capacity to reduce due to a clogging of the lint trap filter is increased, so that the number of cleaning the filter can be reduced.

In accordance with embodiments of the the present invention, since filters are installed on the bag-shaped filter formation surface in the drying air circulation channel, a large lint capturing area can be obtained. Further, the bag-shaped filter formation surface expanded toward the downstream of the air flow can provide a high lint capturing performance.

Moreover, the conventional problem of the bag-shaped lint trap filter regarding the difficulty of removing lint therefrom can be overcome by configuring the filter formation surface so that it can be opened in a simple manner, thus obtaining a high maintenance convenience for the filters.

Brief Description of the Drawings

The above and other objects and features of the present invention will become apparent from the following description of preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view showing an appearance of a drum type washing and drying machine employing a clothes dryer;

Fig. 2 sets forth a cross sectional configuration view of the drum type washing and drying machine;

Fig. 3 provides a cross sectional configuration view of a lint trap filter attached to the clothes dryer; and

Figs. 4A and 4B depict perspective views showing a configuration of the lint trap filter and illustrating an open state of a second filter formation portion.

Detailed Description of the Preferred Embodiments

Hereinafter, a preferred embodiment of the present

invention will be described for the case of incorporating a clothes dryer of the present invention to a drum type washing and drying machine. Figs. 1 and 2 illustrate a configuration of drum type washing and drying machine 1 in accordance with the preferred embodiment of the present invention, while focusing on a structure with a drying function.

Referring to Fig. 1, drum type washing and drying machine 1 in accordance with the preferred embodiment of the present invention is designed as a sloped drum type in which an opening of a rotary drum is provided at a front surface of housing 6 sloping upwardly. Door 9 for loading and unloading clothes at rotary drum is provided on the front surface of housing 6, in a manner capable of being freely opened, and control panel 20 for selecting and inputting a desired operation to drum type washing machine 1 is provided above door 9. Detergent dispenser 21 is also provided at a left side of control panel 20 such that it can be drawn in and out freely, and lint trap filter 22 is provided at a right side of control panel 20 such that it can be detached from housing 6 for maintenance.

Fig. 2 shows an internal configuration of drum type washing and drying machine 1, with a focus on a configuration of a clothes drying device incorporated therein. Water tub 3 accommodating rotary drum 2 therein is installed in housing 6 with a suspension structure such as

damper 5. Rotary drum 2 is driven to rotate by drum driving motor 7 disposed at the rear portion of water tub 3. With door 9 opened, laundry is loaded into rotary drum 2 through laundry loading/unloading opening 11, and detergent is added into detergent dispenser 21. If an operation course is selected and an operation start is inputted by means of control panel 20, wash water will be then supplied into water tub 3; while dissolving the detergent added from detergent dispenser 21 therein. If the wash water containing dissolved detergent therein is supplied up to a predetermined water level corresponding to an amount of the laundry loaded in rotary drum 2, rotary drum 2 will begin to rotate to perform a wash cycle in which the laundry is lifted up by agitation blades 4 provided on the inner cylindrical surface of rotary drum 2 and then dropped, thus generating pounding motions. Upon completion of the wash cycle, water drain valve 15 is opened and soiled wash water is drained to an outside via water drain line 13. After the wash cycle, a rinse cycle and a water-extraction cycle are executed. Since the operations of the rinse cycle and the water-extraction cycle are well known, their description will be omitted.

Also, following the water-extraction cycle, drum type washing and drying machine 1 may be further driven to execute a dry cycle for drying the laundry depending on a selection and input of the operation course set by control

panel 20. Moreover, it is possible to perform only a dry cycle, thereby using washing and drying machine 1 as a clothes dryer to dry wet clothes and the like loaded in rotary drum 2. The drying function will be explained hereinafter in detail.

As shown in Fig. 2, components for the drying function are disposed in an upper portion of housing 6, and there is formed an air circulation channel for circulating the air, which is communicated with an air inlet and an air outlet provided at water tub 3. Installed in the air circulation channel is blower 23. By rotating blower 23, damp air exhausted from water tub 3 through air outlet 24 is run through dehumidification unit or dehumidification pipe 25 having heat exchanger 26 therein, first connection hose 29, lint trap filter 22, air flow pipe 27, second connection hose 30 and air introduction pipe 16 to be re-routed into water tub 3 via air inlet 28, as indicated by arrows in Fig. 2.

Though not shown, a heater is installed in air introduction pipe 16 to heat air. Heated air is blown into water tub 3 through air inlet 28 and into rotary drum 2 through drum perforations 8 provided in a cylindrical wall of rotary drum 2. The heated air introduced in rotary drum 2 comes in contact with laundry or clothes (hereinafter, referred to as clothes generally), whereby moisture in the clothes is evaporated. The damp air containing the moisture

from the clothes is exhausted into dehumidification pipe 25 through air outlet 24. While passing through the dehumidification pipe 25, the damp air is cooled by cooling water flowing along the surface of heat exchanger 26 and
5 dehumidified as the moisture contained therein is condensed. The condensed water is released to the outside through a water drain conduit along with the cooling water, and the dehumidified air is then blown onto lint trap filter 22, in which lint such as threads is removed from the dehumidified
10 air. In general, lint is generated more easily as the dry cycle proceeds and thus generated lint is stuck to blower 23 or pipes. In order to overcome this problem, it may become necessary to provide lint trap filter 22. That is because lint trap filter 22 captures the lint which may otherwise be
15 stuck, thereby preventing a deterioration of air blow capacity. The dehumidified lint-free air is then heated by the heater and is re-circulated into water tub 3 via air inlet 28. As such air circulation is repeated for a preset period of time, the clothes accommodated in rotary drum 2
20 are dried.

Hereinafter, the configuration of lint trap filter 22 will be explained in detail with reference to Figs. 3 to 4B. Fig. 3 is a cross sectional view showing lint trap filter 22 and its neighboring components, and Figs. 4A and 4B are
25 perspective views of lint trap filter 22 detached from housing 6.

As shown in Fig. 1, lint trap filter 22 is configured to be detachable from the front surface of housing 6 such that its maintenance work for, e.g., cleaning filters therein can be performed easily. Specifically, lint trap
5 filter 22 has veneer 44 configured such that its surface is connected with the outer front surface of housing 6 as a continuous surface. Below veneer 44, rotary panel 45 is installed such that its surface is connected with the surface of veneer 44 as a continuous surface. If a user
10 presses an upper portion of rotary panel 45 lightly, rotary panel 45 held in its place by being pressurized by, e.g., a spring will be rotated about rotary shaft 59 provided at its inner lower portion. Thus, a finger can be placed to a lower inner space of veneer 44 and used to pull it outward,
15 thus detaching veneer 44 from washing and drying machine 1. Fig. 4A shows detached lint trap filter 22 thereof.

Lint trap filter 22 captures lint from the air blown thereto through its filter formation surface 40. Filter formation surface 40 is configured to have a shell structure
20 formed of an assembly of first filter formation portion 41 and second filter formation portion 42. First filter formation portion 41 and second filter formation portion 42 are formed by covering openings provided at a peripheral wall of a half-shell shaped receptacle, e.g., a lower wall
25 and a lateral wall thereof, respectively, with filter sheets 43, and they are connected with each other via hinge

mechanism 46 at downstream of air flow, while providing air introduction opening 47 upstream of the air flow. As shown in Fig. 3, lint trap filter 22 is installed in filter accommodation room 55 provided with intake opening 34
5 connected to first connection hose 29 and discharge opening 35 connected to air flow pipe 27 of the air circulation channel shown in Fig. 2 by being pushed inward from the front surface portion of housing 6 up to a preset position.

On its side faced toward the front portion of housing
10 6, filter accommodation room 55 is provided with filter loading/unloading opening 57 through which lint trap filter 22 is loaded into or unloaded from filter accommodation room 55, and sealing protrusion 56 is formed at substantially a middle portion of the top surface of filter accommodation
15 room 55 in a manner as to contact the top surface of second filter formation portion 42 in order to seal it. If lint trap filter 22 is inserted into filter accommodation room 55, filter loading/unloading opening 57 will be closed and sealed by packing member 48 provided at lint trap filter 22,
20 and second filter formation portion 42's end portion on the upstream side of the air flow will be closed and sealed by sealing protrusion 56. Therefore, there is formed an air flow path in which the air introduced from intake opening 34 flows through filter sheets 43 on filter formation surface
25 40 to be directed into air flow pipe 27 through discharge opening 35. Here, lint contained in the air flowing through

the air flow path is captured by filter sheets 43.

Filter formation surface 40 forms a bag-shaped space by having the assembly of first filter formation portion 41 and second filter formation portion 42 overlapped on top of each other, and it is disposed in the air flow path while it is expanded toward the downstream of the air flow and in a bag shape. Since air is exhausted from inside of the bag shaped space defined by filter formation surface 40 toward its vicinities, a large lint capturing area is obtained by filter sheets 43 attached to the openings of first filter formation portion 41 and second filter formation portion 42. Further, since first filter formation portion 41 is arranged to face discharge opening 35, a mainstream of the air flow heads toward first filter formation portion 41, while a sub-stream of the air flow runs to second filter formation portion 42. For this reason, the amount of lint captured by first filter formation portion 41 is greater, whereby it is highly likely that first filter formation portion 41 may be clogged with the lint accumulated therein faster than second filter formation portion 42. Therefore, in case the air permeability of first filter formation portion 41 is reduced, the mainstream of the air flow is redirected toward second filter formation portion 42, so that second filter formation portion 42 plays a major role in trapping lint. In other words, with the presence of the two filters, one can be substituted with the other when one of them is clogged with

the lint. Therefore, without suffering from deterioration of air blow capacity, the function of capturing the lint from the air can be maintained stably for a longer period of time.

5 Though a bag-shaped filter, like lint trap filter 22 configured as described above, has a merit in that it is capable of providing a large lint capturing area and a high lint capturing performance, a cleaning task for removing lint from the filter becomes difficult because the lint is
10 accumulated in the inside of the bag shaped space. In accordance with the present invention employing hinge mechanism 46, it is, however, possible to disassemble and open bag-shaped filter formation surface 40 as described above, and thus the cleaning task for removing the lint from
15 the inside of the bag space can be conducted simply.

 As shown in Fig. 4A, when lint trap filter 22 is taken out of housing 6 to conduct a maintenance work, since the lint is collected inside the filter formation surface 40, dispersing of the lint out of lint trap filter 22 due to a
20 vibration or an impact caused by the action of pulling and taking out lint trap filter 22 happens very rarely. After being taken out of housing 6, second filter formation portion 42 can be opened via hinge mechanism 46 up to a state in which it is laid on the same plane with first
25 filter formation portion 41, as shown in Fig. 4B. In this way, the lint accumulated inside the lint trap filter 22 can

be simply removed.

Moreover, when first filter formation portion 41 is overlapped on and covered by second filter formation portion 42, as shown in Fig. 4A, lug 42a formed on a leading end of second filter formation portion 42 is locked into recess 41a provided at an edge of air introduction opening 47 of first filter formation portion 41. Therefore, second filter formation portion 42 can be prevented from being opened due to, e.g., the impact caused by taking out lint trap filter 22, whereby the lint accumulated therein can be prevented from being dispersed out. To open second filter formation portion 42 from the state illustrated in Fig. 4A, a user would insert a tip of a finger into recessed portion 41b provided at first filter formation portion 41 to draw up the leading end of second filter formation portion 42. This allows lug 42a to be released from recess 41a, rendering second filter formation portion 42 unfolded as shown in Fig. 4B.

Furthermore, when second filter formation portion 42 is overlapped on first filter formation portion 41, peripheral protruding portion 49a provided at first filter formation portion 41 is fitted into groove 49b formed on the periphery of second filter formation portion 42 corresponding thereto, forming a shell structure. As a result, air leakage can be prevented at a portion where the two overlapped filter portions contact each other.

Therefore, the bag-shaped filter assembly of the two filters is configured to be air-tightly connected while it is possible to unfold it.

5 Though a hinge mechanism is preferably employed as a means for separating second filter formation portion 42 from first filter formation portion 41, it is also possible to separate second filter formation portion 42 from first filter formation portion 41 by using a slide mechanism or a fitness mechanism.

10 Though the above discussions refer to a situation where the preferred embodiment of the present invention is applied to a drum type washing and drying machine, the present invention can also be applied to a clothes dryer for drying clothes or to a vertical washing machine.

15 In accordance with the preferred embodiment of the present invention, it is possible to effectively remove lint generated during a dry cycle which tends to accumulate with the progression of the dry cycle. This prevents the lint from obstructing an air circulation, thereby allowing
20 clothes to be dried under a sterile condition. Further, by restraining a reduction of air blow capacity caused by the lint accumulation, the dry cycle can be performed without suffering from a decreased drying efficiency. Moreover, by configuring a filter in a bag shape, lint capturing capacity
25 can be increased, while it is also possible to remove lint accumulated in the bag in a simple manner. Thus, a clothes

dryer featuring a high maintenance convenience can be provided.

While the invention has been shown and described with respect to the preferred embodiments, it will be understood
5 by those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

What is claimed is:

1. A clothes dryer comprising:

a housing having a filter accommodation room in a upper portion of the housing;

a drying chamber for accommodating clothes therein;

a drying air circulation channel for blowing hot air heated by a heating unit into the drying chamber, for exhausting damp air containing moisture evaporated from the clothes from the drying chamber, for running the damp air through a dehumidification unit, for re-heating the dehumidified air with the heating unit and for re-circulating the heated air back into the drying chamber; and

a lint trap filter, installed in an air flow path of the air circulation channel, for filtering lint from air flowing therethrough,

wherein the lint trap filter is configured to be installed at a preset position in the filter accommodation room by being pushed inward from a front surface portion of the housing and to be unloaded from the filter accommodation room by being pulled outward from the front surface portion of the housing,

wherein an intake opening for introducing air from the drying chamber is provided at a front bottom portion of the filter accommodation room, and a discharge opening for exhausting the introduced air is provided at a rear bottom portion of the filter accommodation room,

wherein the lint trap filter is formed of a filter formation surface which has an air introduction opening opened toward the intake opening and is expanded in a bag shape toward

the discharge opening,

wherein the filter formation surface is formed of an assembly of a first filter formation portion and a second filter formation portion, each being formed by attaching a filter sheet to openings provided at a peripheral wall of a half-shell shaped receptacle, and the first filter formation portion and the second filter formation portion are detachably connected to each other at a position between peripheries of the openings of the respective filter formation portions, and

wherein the first filter formation portion is arranged to face the discharge opening to form a mainstream air flow path and the second filter formation portion is arranged to be positioned above the first filter formation portion to form a sub-stream air flow path in communication with the discharge opening through an upper part and a rear part of the filter formation surface.

2. The clothes dryer of claim 1, wherein the first filter formation portion and the second filter formation portion are detachably connected to each other via a hinge mechanism at the rear part of the filter formation surface.